PBEEEP
State Government

Public Buildings Enhanced Energy Efficiency Program

Investigation Report for Riverland Community College – Owatonna Campus

Minnesota STATE COLLEGES & UNIVERSITIES

Riverland COMMUNITY COLLEGE
A Technical & Community College

3/15/2012

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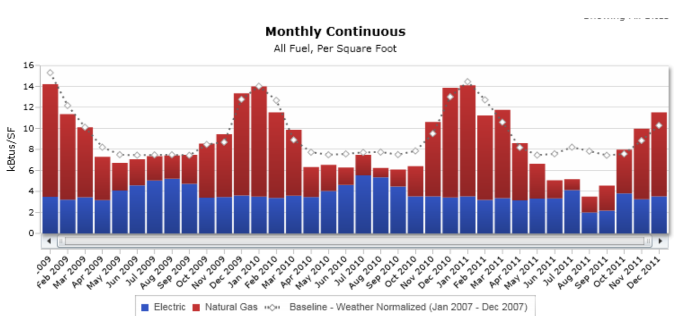
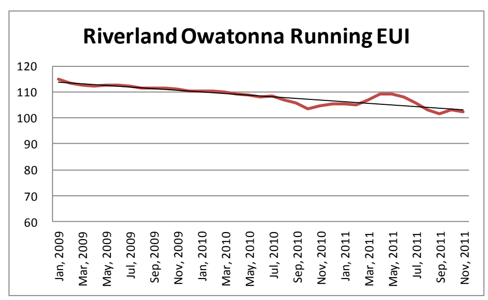
PBEEEP State Government

Investigation Overview

The goal of a PBEEEP Energy Investigation is to identify energy savings opportunities with a payback of fifteen years or less. Particular emphasis is on finding those opportunities that will generate savings with a relatively fast (1 to 5 years) and certain payback. During the investigation phase the provider conducts a rigorous analysis of the building operations. Through observation, targeted functional testing, and analysis of extensive trend and portable logger data, the RCx Provider identifies deficiencies in the operation of the mechanical equipment, lighting, envelope, and related controls. The investigation of Riverland Community College was performed by Hallberg Engineering, Inc. This report is the result of that information.

Payback Information and Energy Savings				
Total Project costs (Without Co-funding)			**Project costs with Co-funding**	
Total costs to date including study	$10,983		Total Project Cost	$21,936
Future costs including Implementation , Measurement & Verification	$11,043		Study and Administrative Cost Paid with ARRA Funds	($12,093)
Total Project Cost	$21,936		Utility Rebates	($0)
			Total costs after co-funding	$9,843
Estimated Annual Total Savings ($)	$2,878		Estimated Annual Total Savings ($)	$2,878
Total Project Payback	7.7		Total Project Payback with co-funding	3.4
Electric Energy Savings	**9.3%**	**and**	**Gas Energy Savings**	**2.5%**





Year	Days	SF	Total kBtu	Normalized Baseline kBtu	Change from Baseline kBtu	% Change	Total Energy Cost $	Average Cost Rate $ /kBtu
2009	365	24,271	2,678,518	2,745,358	-66,840	-2%	$50,625.14	$0.02
2010	365	24,271	2,553,233	2,712,493	-159,260	-6%	$50,836.11	$0.02
2011	365	24,271	2,429,814	2,699,098	-269,284	-10%	$43,634.26	$0.02

Riverland Community College Owatonna Consumption Report

The energy use at Riverland Community College Owatonna dropped approximately 9% over the period of the investigation.

Summary Tables

Facility Name	Riverland Community College
Location	965 Alexander Drive SW, Owatonna, MN 55060
Facility Manager	Judy Enright
Number of Buildings Investigated	1
Interior Square Footage Investigated	25,471
PBEEEP Provider	Hallberg Engineering
Study Period	January 2011 through December 2011
Annual Energy Cost	$43,634 (2011)
Utility Company	Owatonna Public Utilities (Electric and Natural Gas)
Site Energy Use Index (EUI)	108 kBtu/ft^2 (start of study) 99 kBtu/ft^2 (end of study
Benchmark EUI (from B3)	108 kBtu/ft^2

Mechanical Equipment Included in Investigation: Summary Table	
Total	**Equipment Description**
1	Andover Continuum Building Automation System
1	Buildings
25,471	Interior Square Feet
1	Air Handler
30	VAV Boxes
1	Chiller
4	Hot Water Boilers (natural gas)
3	Pumps (HW and CHW)
237	Points for trending

Implementation Information			
Estimated Annual Total Savings ($)		5.1% Savings	$2,878
Total Estimated Implementation Cost ($)			$9,843
GHG Avoided in U.S Tons (CO2e)			24
Electric Energy Savings (kWh) (2011 Usage 275,637 kWh)		9.3 % Savings	25,541
Gas Energy Savings (Therms) (2011 Usage was 14,893 Therms)		2.5 % Savings	379
Statistics			
Number of Measures identified			4
Number of Measures with payback < 3 years			2
Screening Start Date	06/8/2010	Screening End Date	09/24/2010
Investigation Start Date	12/16/2010	Investigation End Date	12/22/2011
Final Report	3/15/2012		

Riverland Community College Owatonna Cost Information			
Phase		**To date**	**Estimated Future Cost**
Screening		$1,893	
Investigation [Provider]*		$5,000	
Investigation [CEE]*		$4,000	$200
Implementation			$9,843
Implementation [CEE]			$500
Measurement & Verification			$500
Total		$10,893	$11,043

Co-funding Summary	
Study and Administrative Cost	$12,093
Utility Co-Funding - Estimated Total ($)	$0
Total Co-funding ($)	$12,093

*Some project costs have been prorated between Austin and Owatonna based on square footage.

Riverland Community College Overview

The energy investigation identified 5.1% of total energy savings at Riverland Community College in Owatonna with measures that payback in less than 15 years and do not adversely affect occupant comfort. The energy savings opportunities identified at Riverland Community College include adjusting equipment schedules to match actual occupancy period in buildings, implementing a control sequence that utilizes a duct static pressure rest for periods when the air handling fans can run at lower speeds, and adding variable frequency drives to the hot water pumps. The total cost of implementing all the measures is $9,843.

Implementing all these measures can save the facility approximately $2,878 a year. In addition to the 5.1% savings that these measures will lead to, we note that during the period of the PBEEEP investigation energy use at Riverland Community College decreased approximately 9% compared to the year prior to the study. It is now 9% below the benchmark value according to the Minnesota Benchmarking and Beyond database (B3).

The campus has a hot water boiler plant with four small boilers that operate all year. During the winter, no more than three boilers are required to meet the needs of the spaces. During the summer, one boiler operates to provide reheat. There is one air-cooled chiller that provides chilled water to the air handler.

All of the mechanical equipment in the building has digital actuation and is controlled by the Andover Continuum building automation system. The only exception to this is a small ventilator unit that serves a server room.

The majority of the interior lighting at the campus is 28W T8 fixtures and is controlled by manual switches except for in the classrooms, which have motion detectors. The exterior lighting operates based on a schedule.

Findings Summary

Site: Riverland CC Owatonna

Eco #	Building	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
1	College and University Center	AHU Run Time	$108	$1,218	0.09	$0	0.09	9
2	College and University Center	AHU Duct Static Pressure Setpoint is constant	$1,760	$984	1.79	$0	1.79	9
3	College and University Center	Bathroom exhaust fan runs 24/7 all year.	$410	$83	4.92	$0	4.92	1
4	College and University Center	No VFD installed for hot water pumps P-1 and P-2	$7,565	$592	12.77	$0	12.77	5
		Total for Findings with Payback 3 years or less:	**$1,868**	**$2,202**	**0.85**	**$0**	**0.85**	**18**
		Total for all Findings:	**$9,843**	**$2,878**	**3.42**	**$0**	**3.42**	**24**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Riverland Owatonna

Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a.1 (1)	Time of Day enabling is excessive	**1**			
a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive		1		
a.3 (3)	Lighting is on more hours than necessary.		1		
a.4 (4)	OTHER_Equipment Scheduling/Enabling		1		
b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or		1		
b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum		1		
b.3 (7)	OTHER_Economizer/OA Loads		1		
c.1 (8)	Simultaneous Heating and Cooling is present and excessive		1		
c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement		1		
c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints		1		
c.4 (11)	OTHER_Controls		1		
d.1 (12)	Daylighting controls or occupancy sensors need optimization.		1		
d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.		1		
d.3 (14)	Fan Speed Doesn't Vary Sufficiently	**1**			
d.4 (15)	Pump Speed Doesn't Vary Sufficiently		1		
d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary	**1**			
d.6 (17)	Other_Controls (Setpoint Changes)	**1**			
e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal		1		
e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal		1		
e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal		1		
e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal		1		

e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal		1		
e.6 (22)	Other_Controls (Reset Schedules)		1		
f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit		1		
f.2 (24)	Pump Discharge Throttled		1		
f.3 (25)	Over-Pumping		1		
f.4 (26)	Equipment is oversized for load.		1		
f.5 (27)	OTHER_Equipment Efficiency/Load Reduction		1		
g.1 (28)	VFD Retrofit - Fans		1		
g.2 (29)	VFD Retrofit - Pumps	**1**			
g.3 (30)	VFD Retrofit - Motors (process)		1		
g.4 (31)	OTHER_VFD		1		
h.1 (32)	Retrofit - Motors		1		
h.2 (33)	Retrofit - Chillers		1		
h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)		1		
h.4 (35)	Retrofit - Boilers		1		
h.5 (36)	Retrofit - Packaged Gas fired heating		1		
h.6 (37)	Retrofit - Heat Pumps		1		
h.7 (38)	Retrofit - Equipment (custom)		1		
h.8 (39)	Retrofit - Pumping distribution method		1		
h.9 (40)	Retrofit - Energy/Heat Recovery		1		
h.10 (41)	Retrofit - System (custom)		1		
h.11 (42)	Retrofit - Efficient Lighting		1		
h.12 (43)	Retrofit - Building Envelope		1		
h.13 (44)	Retrofit - Alternative Energy		1		
h.14 (45)	OTHER_Retrofit		1		
i.1 (46)	Differed Maintenance from Recommended/Standard		1		

i.2 (47)	Impurity/Contamination		1		
i.3 ( )	Leaky/Stuck Damper		1		
i.4 ( )	Leaky/Stuck Valve		1		
i.5 (48)	OTHER_Maintenance				1
j.1 (49)	OTHER		1		

Findings Glossary: Findings Examples

a.1 (1)	**Time of Day enabling is excessive**
	• HVAC running when building is unoccupied. Equipment schedule doesn't follow building occupancy • Optimum start-stop is not implemented • Controls in hand
a.2 (2)	**Equipment is enabled regardless of need, or such enabling is excessive**
	• Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design. • Supply air temperature and pressure reset: cooling and heating
a.3 (3)	**Lighting is on more hours than necessary**
	• Lighting is on at night when the building is unoccupied • Photocells could be used to control exterior lighting • Lighting controls not calibrated/adjusted properly
a.4 (4)	**OTHER Equipment Scheduling and Enabling**
	• Please contact PBEEEP Project Engineer for approval
b.1 (5)	**Economizer Operation – Inadequate Free Cooling**
	• Economizer is locked out whenever mechanical cooling is enabled (non-integrated economizer) • Economizer linkage is broken • Economizer setpoints could be optimized • Plywood used as the outdoor air control • Damper failed in minimum or closed position
b.2 (6)	**Over-Ventilation**
	• Demand-based ventilation control has been disabled • Outside air damper failed in an open position • Minimum outside air fraction not set to design specifications or occupancy
b.3 (7)	**OTHER Economizer/Outside Air Loads**
	• Please contact PBEEEP Project Engineer for approval
c.1 (8)	**Simultaneous Heating and Cooling is present and excessive**
	• For a given zone, CHW and HW systems are unnecessarily on and running simultaneously • Different setpoints are used for two systems serving a common zone
c.2 (9)	**Sensor / Thermostat needs calibration, relocation / shielding, and/or replacement**
	• OAT temperature is reading 5 degrees high, resulting in loss of useful economizer operation • Zone sensors need to be relocated after tenant improvements • OAT sensor reads high in sunlight
c.3 (10)	**Controls "hunt" / need Loop Tuning or separation of heating/cooling setpoints**
	• CHW valve cycles open and closed • System needs loop tuning – it is cycling between heating and cooling
c.4 (11)	**OTHER Controls**
	• Please contact PBEEEP Project Engineer for approval
d.1 (12)	**Daylighting controls or occupancy sensors need optimization**
	• Existing controls are not functioning or overridden • Light sensors improperly placed or out of calibration
d.2 (13)	**Zone setpoint setup / setback are not implemented or are sub-optimal**
	• The cooling setpoint is 74 ºF 24 hours per day
d.3 (14)	**Fan Speed Doesn't Vary Sufficiently**
	• Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design. • Supply air temperature and pressure reset: cooling and heating

d.4 (15)	**Pump Speed Doesn't Vary Sufficiently**
	• Pump runs at 15 PSI on peak day. Lowering pressure to 12 does not create comfort problem and the flow is per design. Low ΔT across the chiller during low load conditions.
d.5 (16)	**VAV Box Minimum Flow Setpoint is higher than necessary**
	• Boxes universally set at 40%, regardless of occupancy. Most boxes can have setpoints lowered and still meet minimum airflow requirements.
d.6 (17)	**Other Controls (Setpoint Changes)**
	• Please contact PBEEEP Project Engineer for approval
e.1 (18)	**HW Supply Temperature Reset is not implemented or is sub-optimal**
	• HW supply temperature is a constant 180 ºF. It should be reset based on demand, or decreased by a reset schedule as OAT increases. • DHW Setpoints are constant 24 hours per day
e.2 (19)	**CHW Supply Temperature Reset is not implemented or is sub-optimal**
	• CHW supply temperature is a constant 42 ºF. It could be reset, based on demand or ambient temperature.
e.3 (20)	**Supply Air Temperature Reset is not implemented or is sub-optimal**
	• The SAT is constant at 55 ºF. It could be reset to minimize reheat and maximize economizer cooling. The reset should ideally be based on demand (e.g., looking at zone box damper positions), but could also be reset based on OAT.
e.4 ( )	**Supply Duct Static Pressure Reset is not implemented or is suboptimal**
	• The Duct Static Pressure (DSP) is constant at 1.5" wc. It could be reset to minimize fan energy. The reset should ideally be based on demand (e.g. looking at zone box damper positions), but could also be reset based on OAT.
e.5 (21)	**Condenser Water Temperature Reset is not implemented or is sub-optimal**
	• CW temperature is constant leaving the tower at 85 ºF. The temperature should be reduced to minimize the total energy use of the chiller and tower. It may be worthwhile to reset based on load and ambient conditions.
e.6 (22)	**Other Controls (Reset Schedules)**
	• Please contact PBEEEP Project Engineer for approval
f.1 (23)	**Lighting system needs optimization - Spaces are overlit**
	• Lighting exceeds ASHRAE or IES standard levels for specific space types or tasks
f.2 (24)	**Pump Discharge Throttled**
	• The discharge valve for the CHW pump is 30% open. The valve should be opened and the impeller size reduced to provide the proper flow without throttling.
f.3 (25)	**Over-Pumping**
	• Only one CHW pump runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.
f.4 (26)	**Equipment is oversized for load**
	• The equipment cycles unnecessarily • The peak load is much less than the installed equipment capacity

f.5 (27)	**OTHER Equipment Efficiency/Load Reduction**	
		• Please contact PBEEEP Project Engineer for approval
g.1 (28)	**VFD Retrofit Fans**	
		• Fan serves variable flow system, but does not have a VFD. • VFD is in override mode, and was found to be not modulating.
g.2 (29)	**VFD Retrofit - Pumps**	
		• 3-way valves are used to maintain constant flow during low load periods. • Only one CHW pumps runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.
g.3 (30)	**VFD Retrofit - Motors (process)**	
		• Motor is constant speed and uses a variable pitch sheave to obtain speed control.
g.4 (31)	**OTHER VFD**	
		• Please contact PBEEEP Project Engineer for approval
h.1 (32)	**Retrofit - Motors**	
		• Efficiency of installed motor is much lower than efficiency of currently available motors
h.2 (33)	**Retrofit - Chillers**	
		• Efficiency of installed chiller is much lower than efficiency of currently available chillers
h.3 (34)	**Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)**	
		• Efficiency of installed air conditioner is much lower than efficiency of currently available air conditioners
h.4 (35)	**Retrofit - Boilers**	
		• Efficiency of installed boiler is much lower than efficiency of currently available boilers
h.5 (36)	**Retrofit - Packaged Gas-fired heating**	
		• Efficiency of installed heaters is much lower than efficiency of currently available heaters
h.6 (37)	**Retrofit - Heat Pumps**	
		• Efficiency of installed heat pump is much lower than efficiency of currently available heat pumps
h.7 (38)	**Retrofit - Equipment (custom)**	
		• Efficiency of installed equipment is much lower than efficiency of currently available equipment
h.8 (39)	**Retrofit - Pumping distribution method**	
		• Current pumping distribution system is inefficient, and could be optimized. • Pump distribution loop can be converted from primary to primary-secondary)
h.9 (40)	**Retrofit - Energy / Heat Recovery**	
		• Energy is not recouped from the exhaust air. • Identification of equipment with higher effectiveness than the current equipment.
h.10 (41)	**Retrofit - System (custom)**	
		• Efficiency of installed system is much lower than efficiency of another type of system
h.11 (42)	**Retrofit - Efficient lighting**	
		• Efficiency of installed lamps, ballasts or fixtures are much lower than efficiency of currently available lamps, ballasts or fixtures.

h.12 (43)	**Retrofit - Building Envelope**
	• Insulation is missing or insufficient • Window glazing is inadequate • Too much air leakage into / out of the building • Mechanical systems operate during unoccupied periods in extreme weather
h.13 (44)	**Retrofit - Alternative Energy**
	• Alternative energy strategies, such as passive/active solar, wind, ground sheltered construction or other alternative, can be incorporated into the building design
h.14 (45)	**OTHER Retrofit**
	• Please contact PBEEEP Project Engineer for approval
i.1 (46)	**Differed Maintenance from Recommended/Standard**
	• Differed maintenance that results in sub-optimal energy performance. • Examples: Scale buildup on heat exchanger, broken linkages to control actuator missing equipment components, etc.
i.2 (47)	**Impurity/Contamination**
	• Impurities or contamination of operating fluids that result in sub-optimal performance. Examples include lack of chemical treatment to hot/cold water systems that result in elevated levels of TDS which affect energy efficiency.
i.3 ( )	**Leaky/Stuck Damper**
	• The outside or return air damper on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.
i.4 ( )	**Leaky/Stuck Valve**
	• The heating or cooling coil valve on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.
i.5 (48)	**OTHER Maintenance**
	• Please contact PBEEEP Project Engineer for approval
j.1 (49)	**OTHER**
	• Please contact PBEEEP Project Engineer for approval

Findings Summary

Building: College and University Center
Site: Riverland CC Owatonna

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
1	AHU Run Time	$108	$1,218	0.09	$0	0.09	9
5	Several VAV box minimum heating flow setpoint is higher than design flow. (NOT AN ECO)	$1,200	$702	1.71	$0	1.71	5
2	AHU Duct Static Pressure Setpoint is constant	$1,760	$984	1.79	$0	1.79	9
3	Bathroom exhaust fan runs 24/7 all year.	$410	$83	4.92	$0	4.92	1
4	No VFD installed for hot water pumps P-1 and P-2	$7,565	$592	12.77	$0	12.77	5
6	The mixed air temperature is lower than the outdoor and return air temperature.	$0	$0	0.00	$0	0.00	0
	Total for Findings with Payback 3 years or less:	**$3,068**	**$2,903**	**1.06**	**$0**	**1.06**	**23**
	Total for all Findings:	**$11,043**	**$3,579**	**3.09**	**$0**	**3.09**	**29**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

PBEEEP State Government

Building: College and University Center

FWB Number:	12801	Eco Number:	1
Site:	Riverland CC Owatonna	Date/Time Created:	12/22/2011

Investigation Finding:	AHU Run Time	Date Identified:	3/31/2011
Description of Finding:	The AHU programmed occupied schedule (see images "AHU Schedule 1", "AHU Schdule 2", "AHU Schedule 3") could be reduced based on field observation and discussions with facility staff.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Time of Day enabling is excessive		

Implementer:	In-house staff or controls contractor	Benefits:	Not having equipment start eariler than necessary will save energy
Baseline Documentation Method:	By reviewing the AHU programmed occupied schedule and trend data, the AHU starts earlier than the actual schedule is needed.		
Measure:	Modification of the existing BAS schedule.		
Recommendation for Implementation:	Currently the BAS is programmed to start AHU operation at 6 AM (Mon.-Fri.) and end operation at 10 PM (Mon.-Thu.) & 4 PM (Fri.). Recommend changing the start operation time from 6 AM to 8 AM (Mon.-Fri.). OPTIMUM START: There is an existing Optimum Start program in the Riverland-Owatonna BAS system. The intent of this program is to minimize the unoccupied warm-up period while still achieving comfort conditions by the start of scheduled occupied period. If the AHU occupied schedule is reduced than this program should be activated.		
Evidence of Implementation Method:	The supply fan status, MAT, RAT, DAT, OAT, VFD speed, Heating Valve, and Cooling Valve will be trended for 15 minute intervals for two weeks (one week cooling, one week heating) to verify it is following the schedule specified in the Recommendation for Implementation section of the Findings Workbook. All space temperatures will be trended for one week as well during peak heating season and peak cooling season to assure spaces are warming up or cooling down to the desired setpoints before occupancy of the building.		

Annual Electric Savings (kWh):	8,442	Annual Natural Gas Savings (therms):	379
Estimated Annual kWh Savings ($):	$820	Estimated Annual Natural Gas Savings ($):	$398
Contractor Cost ($):	$108		
PBEEEP Provider Cost for Implementation Assistance ($):	$0		
Total Estimated Implementation Cost ($):	$108		

Estimated Annual Total Savings ($):	$1,218	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.09	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.09	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	9	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	34.0%	Percent of Implementation Costs:	1.0%

Findings Details

Building: College and University Center

FWB Number:	12801	Eco Number:	2
Site:	Riverland CC Owatonna	Date/Time Created:	12/22/2011

Investigation Finding:	AHU Duct Static Pressure Setpoint is constant	Date Identified:	3/31/2011
Description of Finding:	Duct static pressure maintains a constant setpoint of 1" instead of resetting based on the need of air volume being supplied to the VAV boxes.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls (Reset Schedules)
Finding Type:	Supply Duct Static Pressure Reset is not implemented or is sub-optimal		

Implementer:	Controls contractor	Benefits:	By reducing the supply fan speed will help in energy savings.
Baseline Documentation Method:	By reviewing the AHU trend data (duct static pressure).		
Measure:	Add calculation to program to reduce or increase as needed to reset the duct static pressure setpoint		
Recommendation for Implementation:	Currently the BAS is programmed to maintain a constant static pressure in the duct of 1". Recommend programming the BAS to implement a static pressure reset based on polling VAV box damper positions. SUPPLY AIR DUCT STATIC PRESSURE RESET: Static pressure setpoint shall be reset using trim and response logic within the range 0.15 inches to 1.0 inches. When fan is off, freeze setpoint at the minimum value (0.15 inches). While fan is proven on, every two minutes, decrease the setpoint by 0.04 inches if there are two (adj.) or fewer pressure requests. If there are more than two (adj.) pressure requests, increase the setpoint by 0.04. A pressure request is generated when any VAV damper served by the system is wide open.		
Evidence of Implementation Method:	Review control sequence BAS screen for verification that the modifications for the static pressure setpoints have been made. Review the location of the static pressure sensor. Trend the static pressure sensor, supply fan status, fan VFD speed, and a sample of VAV box damper positions at 15 minute intervals for a minimum of 2 week (one week heating, one week cooling). Verify that all of the VAV boxes are maintaining the correct flow rates at maximum flow for all VAV boxes.		

Annual Electric Savings (kWh):	10,139	Contractor Cost ($):	$800
Estimated Annual kWh Savings ($):	$984	PBEEEP Provider Cost for Implementation Assistance ($):	$960
		Total Estimated Implementation Cost ($):	$1,760

Estimated Annual Total Savings ($):	$984	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	1.79	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	1.79	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	9	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	27.5%	Percent of Implementation Costs:	15.9%

Findings Details

Building: College and University Center

FWB Number:	12801	Eco Number:	3
Site:	Riverland CC Owatonna	Date/Time Created:	12/22/2011

Investigation Finding:	Bathroom exhaust fan runs 24/7 all year.	Date Identified:	4/29/2011
Description of Finding:	Bathroom exhaust fan is not tied to a occupied/unoccupied schedule thru the BAS.		
Equipment or System(s):	Other	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Equipment is enabled regardless of need, or such enabling is excessive		

Implementer:	Controls contractor	Benefits:	Equipment will not run 24/7 which will helpwith energy savings.
Baseline Documentation Method:	By reviewing operation of an in the field and discussions with facility staff.		
Measure:	Add the exhaust fan to a schedule and have it start and stop at the same time as the AHU		
Recommendation for Implementation:	Currenty there is no operation schedule setup for the exhaust fan. Recommend programming the BAS to start/stop the exhaust fan based on the AHU operating schedule.		
Evidence of Implementation Method:	Review BAS schedule screen and trend fan status at 15 minute intervals for a minimum of 2 weeks.		

Annual Electric Savings (kWh): Estimated Annual kWh Savings ($):	858 $83	Contractor Cost ($): PBEEEP Provider Cost for Implementation Assistance ($): Total Estimated Implementation Cost ($):	$410 $0 $410

Estimated Annual Total Savings ($): Initial Simple Payback (years): Simple Payback w/ Utility Co-Funding (years): GHG Avoided in U.S. Tons (C02e):	$83 4.92 4.92 1	Utility Co-Funding for kWh ($): Utility Co-Funding for kW ($): Utility Co-Funding for therms ($): Utility Co-Funding - Estimated Total ($):	$0 $0 $0 $0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	2.3%	Percent of Implementation Costs:	3.7%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: College and University Center

FWB Number:	12801	Eco Number:	4
Site:	Riverland CC Owatonna	Date/Time Created:	12/22/2011

Investigation Finding:	No VFD installed for hot water pumps P-1 and P-2	Date Identified:	3/31/2011
Description of Finding:	Visually confirmed there were no VFD tied to the pumps.		
Equipment or System(s):	Pump, HW distribution	Finding Category:	Variable Frequency Drives (VFD)
Finding Type:	VFD Retrofit - Pumps		

Implementer:	Mechanical and controls contractor	Benefits:	By reducing the pump motor will help in energy savings
Baseline Documentation Method:	By reviewing BAS screens, trends and visually confirming that VSD's were not installed on the pumps.		
Measure:	Add VFD's to aid in reduction of pump speed based on differential pressure		
Recommendation for Implementation:	Currenlty the hot water pumps operate at a constant volume/speed. Recommend installing VSD's on the pumps (replace motors) and adding programming to the BAS to control the hot water system as a variable volume system. Replace all but two existing 3-way valves with 2-way valves. The remaining 3-way valves will be used for bypass. The VFD will modulate pump speed based on readings from a differential pressure sensor.		
Evidence of Implementation Method:	Review control sequence BAS screen for verification that the modifications for the hot water loop differential pressure and pump speed have been made. Review the location of the differential pressure sensor. Trend the differentail pressure sensor and pump speed at 15 minute intervals for a minimum of 2 week in the heating and cooling season.		

Annual Electric Savings (kWh):	6,102	Contractor Cost ($):	$6,605
Estimated Annual kWh Savings ($):	$592	PBEEEP Provider Cost for Implementation Assistance ($):	$960
		Total Estimated Implementation Cost ($):	$7,565

Estimated Annual Total Savings ($):	$592	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	12.77	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	12.77	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	5	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	16.6%	Percent of Implementation Costs:	68.5%

Findings Details

Building: College and University Center

FWB Number:	12801	Eco Number:	5
Site:	Riverland CC Owatonna	Date/Time Created:	12/22/2011

Investigation Finding:	Several VAV box minimum heating flow setpoint is higher than design flow. (NOT AN ECO)	Date Identified:	3/31/2011
Description of Finding:	Verified the minimum heating flow setpoint shown on the graphic page against the design minumum heating flow and discovered the flow setpoint is not being controlled to the design flow as shown on the mechanical drawings schedule. The following VAV boxes were identified with higher heating miminum airflow set points: VAV-2,10,11,12,13,22,23,25. NOTE: In the winter the AHU supply fan VSD operates around 80% speed, which would indicate 80% airflow (in heating mode). The original design documents indicated that the minimum heating air flow would be 62%. Heating minimum airflow settings were compared from the design drawings to the actual VAV settings found in the BAS. Multiple boxes were identified that had higher heating minimum settings than the design drawings. After discussing this with the facility operations staff it was determined that the heating airflow minimums were increased based on occupant comfort complaints. This item is not an ECO.		
Equipment or System(s):	VAV terminal unit	Finding Category:	Deleted
Finding Type:	Finding Deleted by Provider		

Implementer:	In-house staff or controls contractor	Benefits:	
Baseline Documentation Method:	By reviewing BAS screens, trend data and existing design/construction documents.		
Measure:	Verify and change the minimum heating flow setpoint on the graphic page.		
Recommendation for Implementation:	In-house staff or controls contractor to verify on the mechanical drawing schedule the minumum heating flow CFM and implement the correct flow CFM on the VAV graphic page. VAV-2,10,11,12,13,22,23,25.		
Evidence of Implementation Method:	Review BAS VAV minimum heating airflow setpoints. Trend VAV airflow for 15 minute intervals for a minimum of 2 weeks in the heating season.		

Annual Electric Savings (kWh):	2,584	Annual Natural Gas Savings (therms):	429
Estimated Annual kWh Savings ($):	$251	Estimated Annual Natural Gas Savings ($):	$451
Contractor Cost ($):	$240		
PBEEEP Provider Cost for Implementation Assistance ($):	$960		
Total Estimated Implementation Cost ($):	$1,200		

Estimated Annual Total Savings ($):	$702	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	1.71	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	1.71	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	5	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	19.6%	Percent of Implementation Costs:	10.9%

PBEEEP State Government

Rev. 2.0 (12/16/2010)

12801 - Owatonna Campus

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive	X	AHU		See ECO #1
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive			Investigation looked for, but did not find this issue.	
	a.3 (3)	Lighting is on more hours than necessary.			Investigation looked for, but did not find this issue.	
	a.4 (4)	OTHER_Equipment Scheduling/Enabling			Investigation looked for, but did not find this issue.	
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)			Investigation looked for, but did not find this issue.	
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.			Investigation looked for, but did not find this issue.	
	b.3 (7)	OTHER_Economizer/OA Loads			Investigation looked for, but did not find this issue.	
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive			Investigation looked for, but did not find this issue.	
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement			Investigation looked for, but did not find this issue.	
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints			Investigation looked for, but did not find this issue.	
	c.4 (11)	OTHER_Controls			Investigation looked for, but did not find this issue.	
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.			Investigation looked for, but did not find this issue.	
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.			Investigation looked for, but did not find this issue.	
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently	X	AHU		See ECO #2
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently			Investigation looked for, but did not find this issue.	
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary	X	AHU		See ECO #5 (This was determined that there was no opportunity for cost savings. R
	d.6 (17)	Other_Controls (Setpoint Changes)	X	Exhaust Fan		See ECO #3
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	
	e.6 (22)	Other_Controls (Reset Schedules)			Investigation looked for, but did not find this issue.	
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit			Investigation looked for, but did not find this issue.	
	f.2 (24)	Pump Discharge Throttled			Investigation looked for, but did not find this issue.	
	f.3 (25)	Over-Pumping			Investigation looked for, but did not find this issue.	
	f.4 (26)	Equipment is oversized for load.			Investigation looked for, but did not find this issue.	
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction			Investigation looked for, but did not find this issue.	
	g.1 (28)	VFD Retrofit - Fans			Investigation looked for, but did not find this issue.	

PBEEEP State Government

Rev. 2.0 (12/16/2010)

12801 - Owatonna Campus

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
g. Variable Frequency Drives (VFD):	g.2 (29)	VFD Retrofit - Pumps	X	Pumps		See ECO #4
	g.3 (30)	VFD Retrofit - Motors (process)			Investigation looked for, but did not find this issue.	
	g.4 (31)	OTHER_VFD			Investigation looked for, but did not find this issue.	
h. Retrofits:	h.1 (32)	Retrofit - Motors			Investigation looked for, but did not find this issue.	
	h.2 (33)	Retrofit - Chillers			Investigation looked for, but did not find this issue.	
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)			Investigation looked for, but did not find this issue.	
	h.4 (35)	Retrofit - Boilers			Investigation looked for, but did not find this issue.	
	h.5 (36)	Retrofit - Packaged Gas fired heating			Investigation looked for, but did not find this issue.	
	h.6 (37)	Retrofit - Heat Pumps			Investigation looked for, but did not find this issue.	
	h.7 (38)	Retrofit - Equipment (custom)			Investigation looked for, but did not find this issue.	
	h.8 (39)	Retrofit - Pumping distribution method			Investigation looked for, but did not find this issue.	
	h.9 (40)	Retrofit - Energy/Heat Recovery			Investigation looked for, but did not find this issue.	
	h.10 (41)	Retrofit - System (custom)			Investigation looked for, but did not find this issue.	
	h.11 (42)	Retrofit - Efficient Lighting			Investigation looked for, but did not find this issue.	
	h.12 (43)	Retrofit - Building Envelope			Investigation looked for, but did not find this issue.	
	h.13 (44)	Retrofit - Alternative Energy			Investigation looked for, but did not find this issue.	
	h.14 (45)	OTHER_Retrofit			Investigation looked for, but did not find this issue.	
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard			Investigation looked for, but did not find this issue.	
	i.2 (47)	Impurity/Contamination			Investigation looked for, but did not find this issue.	
	i.3 ( )	Leaky/Stuck Damper			Investigation looked for, but did not find this issue.	
	i.4 ( )	Leaky/Stuck Valve			Investigation looked for, but did not find this issue.	
	i.5 (48)	OTHER_Maintenance			Not cost-effective to investigate	
j. OTHER	j.1 (49)	OTHER			Investigation looked for, but did not find this issue.	

HALLBERG ENGINEERING

Mechanical/Electrical Consulting Engineers
1750 Commerce Court ♦ White Bear Lake, MN 55110
(651) 748-1100 ♦ Fax (651) 748-9370
Rick Lucio, P.E., Commissioning Project Manager
Kelly Delaney,CxA

MAINTENANCE ITEMS

Riverland Community College
OWATONNA CAMPUS
PBEEEP - Findings - Maintenance Items

Item Number	Location	Description of Item	Recommendations
1	AHU 1	On the graphic page the minimum outdoor air damper setpoint was set to 0% open instead of the required minimum outdoor air of 17.5% damper position for 4350 CFM per the mechanical drawings.	Review and verify and implement the minimum outdoor air damper position from the test and balance report.
2			
3			

PBEEEP
State Government

Public Buildings Enhanced Energy Efficiency Program

SCREENING RESULTS FOR RIVERLAND COMMUNITY COLLEGE-OWATONNA CAMPUS

September 24, 2010

Minnesota
STATE COLLEGES
& UNIVERSITIES

Riverland
COMMUNITY COLLEGE
A Technical & Community College

Campus Overview

Riverland Community College- Owatonna Campus	
Location	965 Alexander Drive SW, Owatonna, MN 55060
Facility Manager	Judy Enright
Number of Buildings	1
Interior Square Footage	25,471
PBEEEP Provider	CEE (Angela Vreeland)
Date Visited	August 5, 2010
Annual Energy Cost	$49,023 (2009)
Utility Company	Owatonna Public Utilities (Electric and Natural Gas)
Site Energy Use Index (EUI)	108.5 kBtu/ft^2 (2009)
Benchmark EUI (from B3)	108.2 kBtu/ft^2

Riverland Community College in Owatonna, MN is a one story 25,471 square foot (sqft) building that houses offices, classrooms, a kitchen/dining area, mechanical space and warehouse space. A 1,200 square foot addition (included in the 25,471 sqft total) is currently under construction and will tie into the existing mechanical and ventilation systems; it will be included in the investigation. There is a map of the campus at the end of this report.

Screening Overview

The goal of screening is to select buildings where an in-depth energy investigation can be performed to identify energy savings opportunities that will generate savings with a relatively short (1 to 5 years) and certain payback. The screening of Riverland Community College in Owatonna was performed by the Center for Energy and Environment (CEE) with the assistance of the facility staff. A walk-through was conducted on August 5, 2010 and interviews with the facility staff were carried out to fully explore the status of the energy consuming equipment and their potential for recommissioning. This report is the result of that information.

Recommendation

An investigation of the energy usage and energy savings opportunities of the building listed below totaling 25,471 interior square feet at the Owatonna Campus of Riverland Community College (CC) is recommended.

Building Name	State ID	Square Footage	Year Built
College and University Center	Unknown	25,471*	2001

*NOTE: This number includes a 1,200 sqft addition that is currently under construction. The new space will be conditioned with the existing mechanical equipment.

Details obtained through the screening process are included in the following:

Energy Use Index B3 Benchmark

The site Energy Use Index (EUI) for the campus is 108.5 kBtu/sqft, which is nearly equal to the B3 Benchmark of 108.2 kBtu/sqft. The median site EUI for State of Minnesota buildings are 23% lower than their corresponding B3 Benchmarks on average.

Metering

The East campus has one natural gas meter and one electrical meter.

Documentation

There is a significant amount of mechanical documentation, including equipment schedules, mechanical plans, balance reports, and control sequences.

Mechanical Equipment

The campus has a hot water boiler plant with four small boilers that operate all year. During the winter, no more than three boilers are required to meet the needs of the spaces. During the summer, one boiler operates to provide reheat. There is one air-cooled chiller that provides chilled water to the air handler.

The following table lists the key mechanical equipment at the facility.

Mechanical Equipment Summary Table	
Quantity	**Equipment Description**
1	Andover Continuum Building Automation System
1	Building
25,471	Interior Square Feet (before 1,200 sqft addition)
1	Air Handler
~30	VAV Boxes
1	Chiller
4	Hot Water Boilers (natural gas)
3	Pumps (HW and CHW)

Controls and Trending

All of the mechanical equipment in the building has digital actuation and is controlled by the Andover Continuum building automation system. The only exception to this is a small ventilator unit that serves a server room. Remote computer access is available for setting up and downloading trend data from the automation system. Trending is not currently done, but the system is capable of trending and the trend data can be exported in Excel format. The points on the automation system for the mechanical equipment are listed in the Building Summary Table below.

Lighting

The majority of the interior lighting at the campus is 28W T8 fixtures and is controlled by manual switches except for in the classrooms, which have motion detectors. The exterior lighting operates based on a schedule.

Reasons for Recommendation

The main reason that Riverland Community College in Owatonna is recommended to move forward with an energy investigation is that the Austin Campus is also recommended for investigation and the two campuses would be investigated together under one PBEEEP project. An investigation of the Owatonna Campus alone would not be cost effective due to the small size of the building and its low annual energy use.

Another reason for recommending this campus for investigation is that the Energy Use Index (EUI) for the site is at the B3 Benchmark EUI. The median site EUI for State of Minnesota buildings are 23% lower than their corresponding B3 Benchmarks. This indicates that the Owatonna Campus can further reduce its energy use.

Building Summary Table

The following tables are based on information gathered from interviews with facility staff, a building walk-through, automation system screen-captures, and equipment documentation. The purpose of the tables is to provide the size and quantity of equipment and the level of control present in each building. It is complete and accurate to the best of our knowledge.

College and University Center					
Area (sqft)	25,471	Year Built	2001	Occupancy (hrs/yr)	3,900

HVAC Equipment

Air Handler

Description	Type	Size	Notes
AHU 1	Variable Volume with VFDs on SF	25,000 cfm, 40 HP SF	CHW and HW, serves VAV boxes

VAV Boxes

Description	Type	Size	Notes
~30 VAV boxes			HW reheat

Chilled Water System

Description	Type	Size	Notes
Chiller	Screw, Air-cooled Chiller	106 Tons	Operates when OAT>65F, CHWST setpoint is 47F
CHW Pump	Constant Volume CHWP	189 gpm, 10 HP	

Hot Water System

Description	Type	Size	Notes
Boiler 1, 2, 3, 4	HW Boilers	327 kBtu/hr each	Staged, used 3 during coldest weather, 1 during summer
Pump 1, 2	Constant Volume HWPs	80 gpm each, 1.5 HP each	Send water to air handlers and HW baseboard heat

Points on BAS

Air Handler

Description	Points
AHU 1	RAT, RARH, Econ damper, OA cfm, MAT, Heat coil, Cooling coil, SF status, SF speed, DAT, DA DSP, OAT, OARH, Econ lockout setpoint, Space temp setpoint, Unoccupied cooling setpoint, Unoccupied heating setpoint, DA DSP setpoint, RA CO2 setpoint, RA CO2

VAV Boxes- *No Points on BAS*

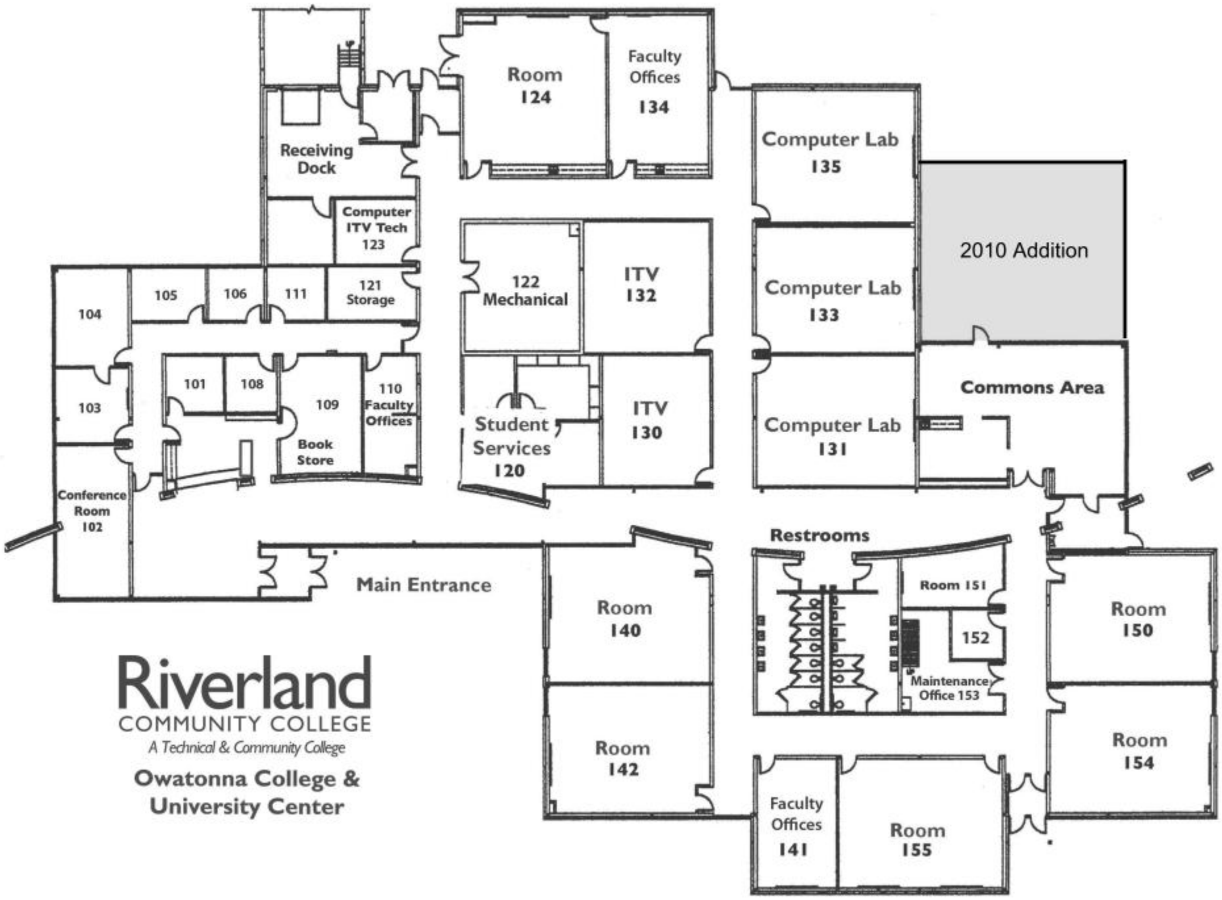
Chilled Water System

Description	Points
System	Chiller status, CHWP status, CHWST, CHWRT

Hot Water System

Description	Points
System	Boiler status, HWST, HWRT, HWP status

<u>Campus Map</u>



PBEEEP Abbreviation Descriptions			
AHU	Air Handling Unit	HP	Horsepower
BAS	Building Automation System	HRU	Heat Recovery Unit
CD	Cold Deck	HW	Hot Water
CDW	Condenser Water	HWDP	Hot Water Differential Pressure
CDWRT	Condenser Water Return Temperature	HWP	Hot Water Pump
CDWST	Condenser Water Supply Temperature	HWRT	Hot Water Return Temperature
CFM	Cubic Feet per Minute	HWST	Hot Water Supply Temperature
CHW	Chilled Water	HX	Heat Exchanger
CHWRT	Chilled Water Return Temperature	kW	Kilowatt
CHWDP	Chilled Water Differential Pressure	kWh	Kilowatt-hour
CHWP	Chilled Water Pump	MA	Mixed Air
CHWST	Chilled Water Supply Temperature	MA Enth	Mixed Air Enthalpy
CRAC	Computer Room Air Conditioner	MARH	Mixed Air Relative Humidity
CV	Constant Volume	MAT	Mixed Air Temperature
DA	Discharge Air	MAU	Make-up Air Unit
DA Enth	Discharge Air Enthalpy	OA	Outside Air
DARH	Discharge Air Relative Humidity	OA Enth	Outside Air Enthalpy
DAT	Discharge Air Temperature	OARH	Outside Air Relative Humidity
DDC	Direct Digital Control	OAT	Outside Air Temperature
DP	Differential Pressure	Occ	Occupied
DSP	Duct Static Pressure	PTAC	Packaged Terminal Air Conditioner
DX	Direct Expansion	RA	Return Air
EA	Exhaust Air	RA Enth	Return Air Enthalpy
EAT	Exhaust Air Temperature	RARH	Return Air Relative Humidity
Econ	Economizer	RAT	Return Air Temperature
EF	Exhaust Fan	RF	Return Fan
Enth	Enthalpy	RH	Relative Humidity
ERU	Energy Recovery Unit	RTU	Rooftop Unit
FCU	Fan Coil Unit	SF	Supply Fan
FPVAV	Fan Powered VAV	Unocc	Unoccupied
FTR	Fin Tube Radiation	VAV	Variable Air Volume
GPM	Gallons per Minute	VFD	Variable Frequency Drive
HD	Hot Deck	VIGV	Variable Inlet Guide Vanes

Conversions
1 kWh = 3.412 kBtu
1 Therm = 100 kBtu
1 kBtu/hr = 1 MBH